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BULLETIN  
OF THE  
TORREY BOTANICAL CLUB

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JUNE, 1916

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Contributions to the Mesozoic flora of the Atlantic coastal plain,  
XI.—Tennessee \*

EDWARD WILBER BERRY

(WITH PLATE 16)

Tennessee west of the river of that name is physiographically and geologically a part of the Atlantic Coastal Plain. The Upper Cretaceous deposits of Tennessee outcrop in a belt of considerable width which extends across the state from north to south immediately west of the Tennessee River. In McNairy and Hardin counties on the south this belt is about sixty-eight miles in width, but the beds become thinner or are overlapped by the Eocene to the northward so that in Henry County on the northern boundary the Cretaceous belt is only about ten miles in width.

The Upper Cretaceous of Tennessee when compared with that of Alabama and Mississippi is seen to be much thinner. According to the nomenclature adopted for Tennessee† the sequence from the top downward is as follows:

Ripley formation . . . . { McNairy sand member  
  { Unnamed member

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\* The last previous contribution of this series appeared in the Bull. Torrey Club 40: 295-300. 1914.

† Stephenson, L. W. U. S. Dept. Int. Geol. Surv. Professional Paper 81. 1914.

[The BULLETIN for May (43: 207-282. *pl.* 10-15) was issued June 16, 1916.]

Selma chalk . . . . .	}	Representing a tongue of chalky material extending northward from about the middle of the Selma chalk of western Alabama
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Eutaw formation . . . Coffee sand member

Tuscaloosa formation.

No fossil plants have been recorded from these beds in Tennessee except *Salex eutawensis* Berry, which is recorded from the Coffee sand near Parsons, Decatur County, Tennessee. While the materials are prevailingly littoral or sublittoral in character with numerous small clay lenses, the bulk of the deposits are sands, and while these are often lignitic or contain petrified wood, determinable fossil plants are rare. The apparent scarcity of fossil plants is due in a measure to lack of exploration, since this area has not yet been surveyed as thoroughly as the balance of the Cretaceous of the Eastern Gulf area. The country is thinly settled, and is for the most part without large towns, railroads or good wagon roads.

That eventually a considerable flora will be known from the Cretaceous of Tennessee is indicated by the results of a single season's detailed work in McNairy and Hardin Counties by Mr. Bruce Wade, a student of the Johns Hopkins University, working under the auspices of the Tennessee Geological Survey.

Determinable plants were obtained by him during the summer of 1915 at two horizons. The first of these is in the McNairy sand member of the Ripley formation and comes from two localities—one in the big cut on the Southern Railway west of Cypress and the other two and one half miles southwest of the town of Selmer, both in McNairy County. The second is in the Coffee sand member of the Eutaw formation and comes from the classic outcrop of the Upper Cretaceous at Coffee Bluff on the Tennessee River in Hardin County, first described by Safford in 1864.\*

The flora collected by Mr. Wade is too limited to warrant a botanical analysis but it is of considerable interest stratigraphically and it possesses an especial botanical interest since hardly any-

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\* Safford, J. M. Am. Jour. Sci. II. 37: 360-372. 1864.

thing is known of the later Upper Cretaceous floras of the Atlantic Coastal Plain. The forms identified with their geographical and geological ranges are shown in the following table:

	Coffee Sand, Tennessee	McNairy Sand, Tennessee	Lower Eutaw, Alabama, Georgia	Cusseta Sand	Black Creek Formation	Magothy Formation	Woodbine Formation	Tuscaloosa Formation	Dakota Formation	Rarian Formation	Emserian of Europe	Turonian of Europe	Colorado Group	Montana Group
<i>Phragmites Prattii</i> . . . . .	×	...	×	...	×	...	...	...	...	...	...	...	...	...
<i>Sabalites</i> sp. . . . .	...	×	...	...	...	...	...	...	...	...	...	...	...	...
<i>Myrica ripleyensis</i> . . . . .	...	×	...	...	...	...	...	...	...	...	...	...	...	...
<i>Salix eulawensis</i> . . . . .	×	...	×	...	×	...	...	...	...	...	...	...	...	...
<i>Dryophyllum gracile</i> . . . . .	...	×	...	...	...	...	...	...	...	...	×	...	...	...
<i>Ficus crassipes</i> . . . . .	×	...	×	...	×	×	...	×	×	...	...	...	...	...
<i>Ficus Krausiana</i> . . . . .	×	...	×	...	×	×	...	×	×	...	...	×	...	...
<i>Ficus ovatifolia</i> . . . . .	×	...	×	...	×	×	...	×	...	×	...	...	...	...
<i>Dewalquea Smithi</i> . . . . .	×	...	...	...	×	...	...	×	...	...	...	...	...	...
<i>Cissites crispus</i> . . . . .	...	×	...	...	...	...	...	...	...	...	×	...	...	...
<i>Bauhinia ripleyensis</i> . . . . .	...	×	...	×	...	...	...	...	...	...	...	...	...	...
<i>Manihotites georgiana</i> . . . . .	×	×	×	×	×	...	...	...	...	...	...	...	...	...
<i>Sterculia Snowii</i>														
<i>tennesseensis</i> . . . . .	...	×	...	...	...	...	...	...	...	...	...	...	...	...
<i>Pterospermities carolinensis</i> . . . . .	×	...	...	...	×	...	...	×	...	...	...	...	...	...
<i>Laurophyllum elegans</i> . . . . .	×	...	...	...	×	×	...	...	×	...	...	...	...	...
<i>Cinnamomum Heerii</i> . . . . .	×	...	×	...	×	×	×	×	×	...	...	...	...	...
<i>Cinnamomum</i> sp. . . . .	...	×	...	...	...	...	...	...	...	...	...	...	...	...
<i>Malapoenna horrellensis</i> . . . . .	...	×	×	...	×	...	...	...	...	...	...	...	...	...
<i>Myrcia havanensis</i> . . . . .	...	×	×	...	...	...	...	...	...	...	...	...	...	...
<i>Eugenia</i> (?) <i>anceps</i> . . . . .	...	×	...	...	...	...	...	...	...	...	...	...	...	...
<i>Andromeda Wardiana</i> . . . . .	×	...	×	...	...	...	...	...	×	...	...	...	...	...
<i>Andromeda novae-caesareae</i> . . . . .	×	...	...	×	×	×	×	×	...	×	...	...	...	...
<i>Diospyros primaeva</i> . . . . .	×	...	×	...	×	×	×	×	×	×	...	×	...	...
<i>Halymenites major</i> . . . . .	×	×	...	...	...	...	...	...	...	...	...	...	×	×

This flora as at present known comprises twenty-four forms, of which *Sabalites* sp., *Cinnamomum* sp., and *Eugenia* (?) *anceps* are poorly characterized. *Halymenites major* is probably not a plant but it is a very characteristic object common in the western United States in the Colorado and Montana series.

The Tennessee Cretaceous flora is remarkable in not showing any traces of ferns or gymnosperms. When the prevailing coarseness of the sediments is considered the absence of ferns is not to be wondered at, but such sediments usually contain an abundance of coniferous twigs and with further exploration these should be discovered. The presence of considerable amber both

in the Coffee sand and in the McNairy sand is a sure indication of conifers, and the petrified wood found at Coffee Bluff is also coniferous and represents an undetermined species of *Cupressinoxylon*. *Araucaria bladenensis*, which is so common in the Black Creek and Lower Eutaw and ranges upward into the Cusseta sand, has not been discovered in Tennessee.

If the two Tennessee horizons be considered separately it will be noted that the Coffee sand flora as at present known consists of fourteen named species and an unidentified *Cupressinoxylon*. None of these are new. It is contrasted with the McNairy sand flora by having but one common species (*Manihotites georgiana*) and by a considerable number of forms that come up from older horizons. Thus it has four species that originate in the Raritan, although none of these are characteristic of the Raritan but of slightly younger horizons. It has three species common to the Woodbine sand, five to the Dakota sandstone, seven to the Magothy formation, and eight to the Tuscaloosa formation. Nine of the Coffee sand forms are common to the basal Eutaw and twelve of the fourteen species are found in the Black Creek formation of the Carolinas. The Coffee sand has not yielded an invertebrate fauna, although on stratigraphic grounds Stephenson refers it to the *Exogyra ponderosa* zone. The present collections unquestionably confirm this reference. Its exact position in this zone is not directly determinable since the possible equivalents of the Coffee sand in Mississippi and Alabama are strictly marine formations without fossil plants, so that we have the familiar but much involved problem of comparing a section in one area with plants and without invertebrates, with a section in an adjoining area containing invertebrates but no plants. While the interpretations resulting from the two classes of evidence are in substantial agreement the paleobotanical evidence would seem to indicate that the Coffee sand may be slightly older than Stephenson (*op. cit.*) postulates, unless we are to assume that 86 per cent. of the Coffee sand flora comes up from older horizons and then becomes extinct in the relatively short interval between the Coffee and the McNairy sand. This is of course possible and future work may demonstrate its truth, but in the present state of our knowledge it seems improbable. Two of the Coffee sand

species, *Ficus Krausiana* and *Diospyros primaeva*, occur in both the Cenomanian and Turonian of Europe.

The McNairy sand flora consists of eleven species, five of which are new and peculiar to this horizon. Only one is common to the Coffee sand, although two additional are found in the basal Eutaw of Alabama or Georgia. Two are common to the Cusseta sand and two occur in the Black Creek formation. The distinctness of the McNairy sand flora is further emphasized by the total absence of any Raritan, Woodbine, Tuscaloosa, Dakota or Magothy species. Singularly enough it has no known elements in common with the Cretaceous floras of the Rocky mountain or Great Plains provinces. Compared with European Upper Cretaceous floras it has two species, *Dryophyllum gracile* and *Cissites crispus*, common to the Emscherian of Prussia and Bohemia and not found elsewhere. While this is not sufficient evidence upon which to base intercontinental correlation it is not without significance, especially in view of the fact that the McNairy sand has not yet furnished any elements common to the fairly abundant floras of the Campanian and Maestrichtian of Europe.

## POALES

### POACEAE

#### PHRAGMITES Trinius

#### PHRAGMITES PRATTII Berry

*Phragmites* sp., Berry, Bull. Torrey Club **34**: 190. *pl. 11, f. 5.* 1907.

*Phragmites Prattii* Berry, Bull. Torrey Club **37**: 191. 1910; U. S. Dept. Int. Geol. Surv. Professional Paper 84: 28, 109. 1914.

Grasslike leaf fragments referred to this species have been described from several localities in the Black Creek formation of the Carolinas and from the lower Eutaw of Georgia. Identical remains occur in the Upper Eutaw of Tennessee.

OCCURRENCE: EUTAW FORMATION, COFFEE SAND MEMBER. Coffee Bluff, Hardin County, Tennessee.

ARECALES

PALMAE

SABALITES Saporta

SABALITES sp.

Fragments of leaves of a large fan palm are present in the basal Ripley beds of Benton County, and in the McNairy sand of McNairy County, Tennessee. They indicate large flabellate leaves with numerous rays 1.5–2 cm. broad with an illy-defined midrib and closeset parallel lateral veins. The texture is coriaceous.

The material is very fragmentary and is altogether insufficient for specific diagnosis. It is in my judgment distinct from the so-called *Sabalites Grayanus* Lesquereux of the Montana Group, *Sabalites magothiensis* Berry of the Magothy formation or *Sabalites carolinensis* Berry of the Middendorf beds of South Carolina.

OCCURRENCE: RIPLEY FORMATION, MCNAIRY SAND MEMBER. One half mile from Camden, Benton County; two and one half miles southwest of Selmer, McNairy County, Tennessee.

MYRICALES

MYRICACEAE

MYRICA Linné

**Myrica ripleyensis** sp. nov.

Leaves of medium size, linear-lanceolate in outline with a gradually cuneate base. Length about 13 cm. Maximum width, in the middle part of the leaf, about 1.75 cm. Margins conspicuously serrate-toothed, the teeth somewhat irregular in size and disposition; distad they are reduced and close-set. They increase in size proximad until in the median and basal part of the leaf, they are large and triangular the intervening sharp sinuses reaching nearly to the midrib and closely simulating our recent *Comptonia* in character. Texture coriaceous. Petiole not preserved, presumably short and stout. Midrib stout, flexuous. Secondaries numerous, diverging from the midrib at wide angles.

about 70 degrees, every third or fourth one straighter than the rest and running to a marginal tooth, the intervening ones somewhat more curved and campodrome.

This is an exceedingly well marked species, quite distinct from previously described forms and resembles closely some of the leaves of our existing *Comptonia peregrina* (Linné) Coulter. It is also much like some of the European Tertiary forms about which so much controversy raged in times past as to whether they were myricaceous or proteaceous.\* For example some of the forms of *Comptonia vindobonensis* (Ettingshausen) Berry are close to the present species. A somewhat similar form is described by Velenovsky from the Bohemian Cretaceous as *Dryandra cretacea*,† and another by Unger from the Cretaceous of Transylvania as *Comptonites antiquus*.‡ These are both generically distinct from the present species as shown by their characteristic habit.

OCCURRENCE: RIPLEY FORMATION, MCNAIRY SAND MEMBER. Camden-Paris Road, thirteen miles northwest of Camden, Benton County; two and one half miles southwest of Selmer, McNairy County, Tennessee.

## SALICALES

## SALICACEAE

### SALIX Linné

#### SALIX EUTAWENSIS Berry

*Salix eutawensis* Berry, Bull. Torrey Club 37: 193. *pl.* 22, *f.* 1-11. 1910; U. S. Dept. Int. Geol. Surv. Professional Paper 84: 109. *pl.* 19, *f.* 3. 1914.

This very characteristic willow, represented by both leaves and fruits in North Carolina is also found in Georgia. It is

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\* The reader who wishes additional information on this point should consult my paper on Living and Fossil Species of *Comptonia*. Amer. Nat. 40: 485-520. *pl.* 1-4. 1906.

† Velenovsky. Fl. Böhm. Kreidef. 2: 1. *pl.* 1, *f.* 1-5. 1883.

‡ Unger. Ueber einige fossile Pflanzenreste aus Siebenbürgen und Ungarn. Sitz. K. Akad. Wiss. Wien 51: 2. *pl.* 1, *f.* 1. 1865.



not present in the material collected by Mr. Wade but was collected some years ago by Mr. Stephenson at the following locality.

OCCURRENCE: EUTAW FORMATION, COFFEE SAND MEMBER. Cut on The North Carolina and St. Louis Railway, east of Parsons, Decatur County, Tennessee.

## FAGALES

### FAGACEAE

#### DRYOPHYLLUM Debey

##### DRYOPHYLLUM GRACILE Debey

*Dryophyllum gracile* Debey, Feuilles querciformes d'Aix-la-Chapelle. Compte rendu Congres bot. et hort. Brussels 10. f. 10, 11. 1881.

*Quercus pseudodrymeja* Velenovsky, Fl. Böhm. Kreidef. 2: 17. pl. 2, f. 21, 22. 1883; 4: 13. pl. 7, f. 10. 1885. Bayer, Sitz. k. Böhm. Gesell. Wiss. 1896: 10. Fric, Archiv. Naturw. Landes. Böhm. 10: 75. pl. 100. 1897.

Leaves oblonglanceolate in outline, with a cuneate base and a gradually narrowed tip. Length about 12 cm. Maximum width, in median part of leaf, ranging from 1.75 cm. to 2.5 cm. Petiole missing. Texture subcoriaceous. Margin with regularly spaced, fairly prominent, nearly straight-serrate teeth. Midrib stout, prominent on the lower surface of the leaf. Secondaries thin, regularly spaced, about fifteen craspedodrome pairs, branching from the midrib at angles of forty-five degrees or more, curving regularly upward, subparallel, terminating in the marginal teeth. Tertiaries thin, partly percurrent and partially alternating, joined midway between adjacent secondaries by a zigzag tertiary. [FIG. 6.]

This well-marked species is represented by five specimens in the small collection from the Cretaceous of Tennessee. None of these are complete, each showing about two thirds of a leaf, enough to demonstrate the identity with the European form. The type material came from the Emscherian where it is recorded from Aachen, Rhenish Prussia; Tannenberg, Bohemia and Kieslingswalde, Silesia, all at about the same horizon, probably representing the Santonian substage of the Emscherian.

OCCURRENCE: RIPLEY FORMATION, McNAIRY SAND MEMBER. Big Cut on Southern Railway near Cypress, two and one half miles southwest of Selmer, McNairy County, Tennessee.

URTICALES

MORACEAE

FICUS Linné

FICUS CRASSIPES (Heer) Heer

*Proteoides crassipes* Heer, Fl. Foss. Arct. 3<sup>2</sup>: 110. *pl.* 31, *f.* 6-8. 1874.

*Ficus crassipes* Heer, *Ibid.* 6<sup>2</sup>: 70. *pl.* 17, *f.* 9a; *pl.* 24, *f.* 1, 2. 1882; Berry, U. S. Dept. Int. Geol. Surv. Professional Paper 84: 37, 110. *pl.* 10, *f.* 12; *pl.* 12, *f.* 8-10. 1914.

The leaves of this species as they occur in the southern Coastal Plain are narrowly lanceolate with gradually narrowed apex and base, about 15 centimeters in length by 2.5 centimeters in greatest width, and resemble *Ficus atavina* Heer in outline but are relatively narrower. The texture is coriaceous and the midrib and petiole are extraordinarily stout in many specimens. The secondary venation when seen is of the usual camptodrome type with relatively long, ascending, curved secondaries.

This species was described originally from the Atane beds of western Greenland, the first rather fragmentary specimens collected having suggested the genus *Proteoides*. It was subsequently recorded from the Dakota sandstone of Kansas by Lesquereux. In the Atlantic Coastal Plain it is found in the Magothy and Black Creek formations, including the Midden-dorf member of the latter, and it is especially common in clays of the Tuscaloosa formation of Alabama. It occurs in the basal beds of the Eutaw formation in Georgia and the present occurrence extends its range upward to near the top of the latter formation.

OCCURRENCE: EUTAW FORMATION, COFFEE SAND MEMBER. Coffee Bluff, Hardin County, Tennessee.

FICUS KRAUSIANA Heer

*Ficus Krausiana* Heer, Neue Denks. Schw. Gesell. 23: 15. *pl.* 5, *f.* 3-6. 1869; Berry, U. S. Dept. Int. Geol. Surv. Professional Paper 84: 38, 110. *pl.* 11, *f.* 4-7; *pl.* 19, *f.* 4. 1914.

Leaves of large size, ovate lanceolate in outline, broadest at or below the middle. Apex and base acutely pointed, the apex

often extended and attenuated. Petiole and midrib stout. Secondaries regular, open, thin, ascending, camptodrome, branching from the midrib at angles of forty-five degrees or more. Texture coriaceous or subcoriaceous. Length about 17 cm. Greatest width about 4 cm.

This species was described by Heer from Moletain in Moravia (Cenomanian), and it has been subsequently identified from a large number of American localities. In the West it occurs in the Dakota sandstone of Kansas and Colorado; in the East it is common from Martha's Vineyard and Block Island to Alabama and is present between these limits in Maryland, North Carolina and South Carolina. It occurs in the lower Eutaw of Georgia and the present record extends its range upward to near the top of the Eutaw.

Associated with this species at the type locality in Moravia are similar leaves which were described by Professor Heer as a different species, *Ficus Mohliana*. These are somewhat larger with a more sparse secondary venation. It seems probable that these merely represent the somewhat larger leaves of *Ficus Krausiana*, but they are not united with it in view of the lack of positive evidence, because *Ficus Mohliana* has priority and this would involve the change of name of this well-known type and horizon marker. In both North and South Carolina fruits are found associated with this species, but whether they are related to it or to some of the other rather numerous species of *Ficus* which occur at the same localities can not be determined.

OCCURRENCE: EUTAW FORMATION, COFFEE SAND MEMBER. Coffee Bluff, Hardin County, Tennessee.

#### FICUS OVATIFOLIA Berry

*Ficus ovata* Newberry, Mon. U. S. Geol. Surv. **26**: 70. *pl.* 24, *f.* 1-3. 1896. Not Don, 1802-3.

*Ficus ovatifolia* Berry, Bull. Torrey Club **36**: 253. 1909.

Leaves ovate in outline, extended above into a narrow, usually pointed apex. Length 8-12 cm. Greatest width, which is in the basal part of the leaf, 4-7 cm. Base broadly rounded and in many specimens slightly decurrent. Margins entire. Primaries, three from the base, the midrib somewhat stouter than the lateral primaries. Secondaries camptodrome.

This species is closely allied to the Raritan species *Ficus Woolsoni* Newberry, differing primarily in its greater elongation and in the tendency of the former to a cordate outline. *Ficus ovatifolia* was described originally from the Raritan formation of New Jersey. It is present in the Black Creek formation of North Carolina and in the lower part of the Eutaw formation in Georgia.

OCCURRENCE: EUTAW FORMATION, COFFEE SAND MEMBER. Coffee Bluff, Hardin County, Tennessee.

## RANALES

### RANUNCULACEAE (?)

#### DEWALQUEA Saporta & Marion

##### DEWALQUEA SMITHI Berry

*Dewalquea Smithi* Berry, *Torreya* 10: 36. f. 1. 1910; U. S. Dept. Int. Geol. Surv. Professional Paper 84: 41. pl. 8, f. 3-9. 1914.

Leaves palmately decompose, the petiole dividing into three principal branches, the angle of divergence varying from twenty to sixty degrees, and the two lateral branches forking at an acute angle 1-2 cm. above their base. The middle leaflet lanceolate in outline, being widest in its central part and tapering almost equally to the acute apex and base. Length 7.5-16 cm. Greatest width 1-4 cm. Margin entire or serrate, usually entire below and serrate in the apical three-fourths, sometimes with large aqualine-serrate teeth. Midrib stout. Secondaries regular, sub-opposite, parallel; about twenty pairs, branching from the midrib at angles varying from forty-five to seventy degrees, usually about fifty degrees, curving upward and running to the marginal teeth, or camptodrome. The base of the leaflet extends downward to within 2 or 3 mm. of the forks of the petiole. Lateral leaflets more or less inequilateral, usually somewhat smaller than the middle leaflet. The internal lateral leaflet is lanceolate, the outer lamina starting at or very near the point where the lateral branch of the petiole forks. The inner lamina, however, extends downward almost to the base of the lateral branch, making the base markedly inequilateral. In general outline, marginal and venation characters, it is identical with the middle leaflet. The outer lateral leaflet is also somewhat inequilateral, but less so than the internal lateral leaflet, the internal lamina starting at

or near the fork and its outer lamina extending more or less below the fork. Marginal and venation characters as in the other leaflets.

This handsome species is abundantly represented in the Middendorf formation of South Carolina, mostly by terminal leaflets. It is common in the Upper Tuscaloosa of Alabama where nearly complete leaves have been collected. It is markedly distinct from the American species of *Dewalquea* previously described, all of which were apparently tripartite. Among the European forms it is quite similar to the Senonian species *Dewalquea insignis* Hos. & v. d. Marck, which is, however, entirely distinct.

OCCURRENCE: EUTAW FORMATION, COFFEE SAND MEMBER. Coffee Bluff, Hardin County, Tennessee.

## ROSALES

### CAESALPINIACEAE

#### BAUHINIA Linné

#### ***Bauhinia ripleyensis* sp. nov.**

Leaves of medium size, more or less bilobate, but much less deeply divided than in the preceding species, obovate in general outline. Length along the midrib 4.5 cm. From apex of lobes to base 6.7 cm. Width across upper part of the leaf 5.5 cm. Apical sinus open, extending about one fourth of the distance toward the base of the leaf, its margins at the tip of the midrib forming an angle of about 90°, curving slightly upward and then conspicuously outward to the pointed tips of the lobes which are directly laterally. Outer margins of the leaf full and rounded, becoming straight toward the broadly cuneate base. Midrib of medium size. Lateral primaries branching from the base at angles with the midrib of about 25 degrees, of medium size, curved upward and then outward, and running to the tips of the lobes. They give off four or five camptodrome secondaries on the outside and two or three on the inside. The midrib, in its upper half, also gives off one or two secondaries on each side. Leaf substance somewhat coriaceous. [FIG. 1.]

This species, which is sparingly represented in the argillaceous greensand marls along Cowikee Creek in Alabama, associated with

shallow water or estuarine mollusks of the Ripley formation, and in the McNairy sand of Tennessee, is markedly distinct from any described species of *Bauhinia*. It is much smaller and less deeply divided than *Bauhinia gigantea* Newberry or *Bauhinia alabamensis* Berry, and is much less ornate in character. It is, on the other hand, much larger than *Bauhinia marylandicus* Berry of the Magothy formation in the Maryland area. It differs from all of these American Cretaceous species in its pointed, outwardly-directed lobes, but is not unlike a number of existing species of this genus.

OCCURRENCE: RIPLEY FORMATION. Right bank of Cowikee Creek, one-eighth of a mile above mouth, Barbour County, Alabama. MCNAIRY SAND MEMBER. Two and one half miles southwest of Selmer, McNairy County, Tennessee.

## GERANIALES

### EUPHORBIACEAE

#### MANIHOTITES Berry

#### MANIHOTITES GEORGIANA Berry

*Manihotites georgiana* Berry, Bull. Torrey Club **37**: 507. f. 1, 2. 1910; U. S. Dept. Int. Geol. Surv. Professional Paper 84: 114. pl. 22; pl. 23; pl. 24, f. 4, 5. 1914.

This remarkable large-leafed species has been somewhat fully described and figured recently. The type was based on nearly perfect material from the Lower Eutaw of McBrides Ford, Georgia. This species has also been recorded from the Cusseta sand member of the Ripley formation at Buena Vista, Georgia. It is present in the Black Creek formation of North Carolina and Mr. Wade's recent collections contain fragmentary but characteristic specimens from both the Eutaw and Ripley formations of Tennessee.

OCCURRENCE: EUTAW FORMATION, COFFEE SAND MEMBER. Coffee Bluff, Hardin County. RIPLEY FORMATION, MCNAIRY SAND MEMBER. Two and one half miles southwest of Selmer, McNairy County, Tennessee.

RHAMNALES

VITACEAE

CISSITES Heer

CISSITES CRISPUS Velenovsky

*Cissites crispus* Velenovsky, Fl. Böhm. Kreidef. 4: 12. *pl.* 4, *f.* 6  
1885. Not Newberry, 1896, Berry, 1906, 1911.

The present species was identified from the Raritan of New Jersey by Newberry and from the Magothy by Berry but neither occurrence represents the European form so that recently I made them the basis of a new species, *Cissites Newberryi*.\*

A perfectly distinct small-leafed form which appears to be identical with the Bohemian type is present in the Ripley of Tennessee. It differs from *Cissites Newberryi* in its relatively shorter and broader form, its crenate instead of serrate or dentate teeth, its less ascending secondaries and its cordate base.

The type and only other known occurrence of *Cissites crispus* is the Chlomeker beds (Emscherian) of Bohemia.

OCCURRENCE: RIPLEY FORMATION, MCNAIRY SAND MEMBER. Two and one half miles southwest of Selmer, McNairy County, Tennessee.

MALVALES

STERCULIACEAE

STERCULIA Linné

*Sterculia Snowii tennesseensis* var. nov.

Leaf bilobate with a bluntly pointed base and gradually narrowed acuminate recurved apical lobes. Length about 11 cm. Width of entire basal part of leaf 2.5–2.75 cm. Width of lobes 1.1–1.6 cm. Margins entire. Texture subcoriaceous. Sinus extending half way to base or less, open, narrowly rounded. Midrib stout, flexuous. Lateral primary stout, diverging from midrib at an acute angle about 3 cm. above the base. Secondaries thin, largely immersed, diverging from primaries at wide angles at regular intervals, arching in a camptodrome manner near the margins. [FIG. 5.]

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\* Berry, E. W. Md. Geol. Surv. Upper Cret. 856. 1916.

This striking form is unfortunately represented by only two specimens both of which are bilobate, although it, like so many fossil and existing species of *Sterculia*, may well have varied from entire to trilobate. Among previously described fossil forms it may be compared with the Magothy species *Sterculia minima* Berry, a smaller more variable form, or with the Dakota sandstone species *Sterculia mucronata* Lesquereux and *Sterculia Snowii* Lesquereux. The latter while often much larger and at times with five lobes is extremely variable. Two named varieties have already been recognized and the general character and venation of the Tennessee form leads me to conclude that it represents another variety of this protean species.

OCCURRENCE: RIPLEY FORMATION, McNAIRY SAND MEMBER. Two and one half miles southwest of Selmer, McNairy County, Tennessee.

#### PTEROSPERMITES Heer

##### PTEROSPERMITES CAROLINENSIS Berry

*Pterospermities carolinensis* Berry, Bull. Torrey Club **34**: 198. *pl. 14*, *f. 2*. 1907.

This characteristic species, which was described from the Black Creek formation of North Carolina, is also not uncommon in the Tuscaloosa formation of Alabama. The present collections extend its range upward to the Coffee Sand Member of the Eutaw formation in which it occurs at Coffee Bluff, Hardin County, Tennessee.

#### THYMELEALES

##### LAURACEAE

##### LAUROPHYLLUM Goeppert

##### LAUROPHYLLUM ELEGANS Hollick

*Laurophyllum elegans* Hollick, Mon. U. S. Geol. Surv. **50**: 81. *pl. 27, f. 1-5*. 1907; Berry, U. S. Dept. Int. Geol. Surv. Professional Paper 84: 53. *pl. 12, f. 6*. 1914.

Leaves elongate-lanceolate, somewhat flexuous, about 12-13 cm. in length by about 2 cm. in greatest width, which is about



midway between the apex and the base; from this point they narrow gradually apically into an attenuated acuminate, usually curved, tip; and basally into a long, narrowly cuneate base. Midrib and petiole stout. Secondaries numerous, usually less close and somewhat coarser than in *Laurophyllum nervillosum*, branching from the midrib at an acute angle below, which becomes more open above the base of the leaf; they are usually more curved than in *L. nervillosum* and more distinctly camptodrome. Tertiaries transverse throughout.

The species is certainly known from the upper Raritan at South Amboy, New Jersey, and is common in the Magothy formation of Maryland. It is sparsely represented in the Black Creek beds of North Carolina and is not uncommon in the Middendorf beds of South Carolina.

OCCURRENCE: EUTAW FORMATION, COFFEE SAND MEMBER. Coffee Bluff, Hardin County, Tennessee.

#### CINNAMOMUM Sprengel

##### CINNAMOMUM HEERII Lesquereux

*Cinnamomum Heerii* Lesquereux, Cretaceous Flora 84. *pl.* 28, *f.* 11. 1874; Mon. U. S. Geol. Surv. 17: 105. *pl.* 15, *f.* 1. 1892; Newberry, Mon. U. S. Geol. Surv. 35: 100. *pl.* 17, *f.* 1-3. 1898; Berry, U. S. Dept. Int. Geol. Surv. Professional Paper 84: 118. *pl.* 21, *f.* 8. 1914.

Leaves coriaceous, entire, ovate in outline, more or less attenuated apically. Base broadly rounded. Primaries three, stout, suprabasilar. Secondaries camptodrome.

The exact status of this species is made out with difficulty. In typical specimens it is clearly distinct from *Cinnamomum Newberryi* Berry in its more regular outline and venation, broader form, more rounded base, and stouter suprabasilar primaries. Other remains have been referred to *Cinnamomum Heerii* which are not typical in some of these distinctive characters, and the well-known variation of the leaves of *Cinnamomum* renders a satisfactory solution of the problem difficult. It does, however, characterize the somewhat younger beds represented in the west by the Dakota sandstone and the Woodbine sand and in the Coastal Plain by the Magothy formation of the north and the Black Creek and Tuscaloosa formations of the south. In the

lower Eutaw of Georgia it is represented by fragments showing the coriaceous texture, broad base, and suprabasilar primaries of the species.

OCCURRENCE: EUTAW FORMATION, COFFEE SAND MEMBER. Coffee Bluff, Hardin County, Tennessee.

CINNAMOMUM sp.

A characteristic *Cinnamomum* of uncertain specific identity occurs in the McNairy sand member of the Ripley formation at the locality two and one half miles southwest of Selmer in McNairy County, Tennessee.

MALAPOENNA Adanson

MALAPOENNA HORRELLENSIS Berry

*Malapoenna horrellensis* Berry, Bull. Torrey Bot. Club **37**: 198.

*pl. 24, f. 1-9.* 1910; U. S. Dept. Int. Geol. Surv. Professional Paper 84: 118. 1914.

Leaves ovate-lanceolate, about 8 cm. long by 2.5 cm. in greatest width; broadest at the evenly rounded or slightly acute base, narrowing gradually upward, the apex narrow and extended but obtusely pointed. Leaf substance thin but persistent, evidently coriaceous in life, as these leaves occur abundantly at a locality where all the vegetable remains were thoroughly macerated before entombment. Secondaries four to six pairs, subopposite, curved upward, camptodrome, branching from the midrib at an acute angle, the lowest pair branching from the top of the petiole and extending upward halfway to the apex or farther, giving the leaf a triple-veined appearance. Perhaps they should be termed lateral primaries, although they are much finer than the fairly stout midrib. The next pair of secondaries branch at a less acute angle, a considerable distance above the base, one third to one half the distance to the apex. Tertiary venation typically lauraceous.

The present species may possibly be confused with *Cinnamomum Heerii* when only the basal part of the leaf is found, but the general proportions and characters of the whole leaf are perfectly distinct.

The genus *Malapoenna* has more than one hundred existing species, chiefly of the Oriental tropics, and is well represented in

the fossil state from the Dakota and Magothy formations upward. It is especially well represented in the Paleocene of Europe and in the Shoshone group of America. Of the two species in the Dakota sandstone of the West, one occurs in the Tuscaloosa formation at Cottondale, Alabama, and the other in the Magothy formation of New Jersey.

OCCURRENCE: RIPLEY FORMATION, McNAIRY SAND MEMBER. Near Cypress and two and one half miles southwest of Selmer, McNairy County, Tennessee.

## MYRTALES

### MYRTACEAE

#### MYRCIA DeCandolle

#### ***Myrcia havanensis* sp. nov.**

Leaves linear-lanceolate in outline, falcate, about 9 cm. in length by 1 cm. in maximum width, which is in the lower half of the leaf. Margins entire. Apex gradually narrowed, acuminate. Base narrowly pointed, decurrent. Petiole very stout, tapering upward, 1.75 cm. in length. Midrib stout, curved. Secondaries numerous, thin, somewhat irregularly spaced, 2–6 mm. apart, branching from the midrib at angles of about forty degrees, running with but slight curvature to the well-marked and nearly straight longitudinal vein which forms a marginal hem less than one half a millimeter from the margin. Texture coriaceous.

The present species is very close to some of the numerous forms which have been from time to time referred to *Eucalyptus Geinitzi* (Heer) Heer. It is, however, distinct from the latter, especially when compared with Heer's type or with the more typical American material. In general it is a smaller leaf with a larger and longer petiole, an outline less inclined toward ovate, and relatively much more produced apically. It is typically *Myrcia*-like in all of its characters. It is found in both the Ripley and Eutaw formations in Alabama and Tennessee.

OCCURRENCE: EUTAW FORMATION. Two miles south of Havana, Hale County, Alabama. RIPLEY FORMATION, McNAIRY SAND MEMBER. Two and one half miles southwest of Selmer, Big Cut on Southern Railway near Cypress, McNairy County; Camden, Benton County, Tennessee.

EUGENIA Linné

**Eugenia (?) anceps** sp. nov.

Coriaceous leaves of variable size and form, lanceolate or oblong lanceolate. Base and apex equally acuminate or apex somewhat more attenuated. Margins entire. Length 7.75–10 cm. Maximum width, midway between the apex and the base, 11–18 mm. Petiole enlarged, short and stout, 3–4 mm. in length. Midrib stout. Secondaries thin, immersed in the leaf substance. [FIGS. 2–4.]

This species is referred with much doubt to *Eugenia*. The material is abundant but poorly preserved and these leaves resemble a variety of forms referred to such genera as *Salix*, *Laurophyllum*, etc.

*Eugenia* has a species in the Tuscaloosa formation of Alabama, another in the Dakota sandstone, and is not uncommon in the Eocene of the Mississippi embayment area.

OCCURRENCE: RIPLEY FORMATION, MCNAIRY SAND MEMBER. Two and one half miles southwest of Selmer, McNairy County, Tennessee.

ERICALES

ERICACEAE

ANDROMEDA Linné

ANDROMEDA NOVAE-CAESAREAE Hollick

*Andromeda novae-caesareae* Hollick; Newberry, Mon. U. S. Geol.

Surv. 26: 121. *pl.* 42, *f.* 9–12, 28–31. 1896; Berry, U. S. Dept.

Int. Geol. Surv. Professional Paper 84: 58, 120. *pl.* 14, *f.* 5, 6; *pl.* 24, *f.* 1. 1914.

Leaves small, thick, and entire, with stout petioles and midribs and obscure secondary venation which is immersed in the thick lamina. Length 2.5–5.0 cm. Width varying from 0.9–1.3 cm. Venation, where visible, showing numerous parallel, camptodrome, relatively long and thin secondaries which branch from the midrib at acute angles. While the majority of these leaves are equally acuminate at both ends there is considerable variation in this respect, and a well-marked tendency is shown in a considerable number of specimens which are relatively broader,

especially in the upper half, toward an obtusely rounded apex, the termination of the midrib showing as a small mucronate point. The base in these forms gradually narrows to the stout petiole.

This species is found as early as the uppermost Raritan in the New Jersey area and is also common in the overlying Magothy. It is exceedingly common throughout the Black Creek formation of the Carolinas and has also been recorded from the Cusseta sand member of the Ripley formation in Georgia. It occurs also in the Woodbine of Texas and the Tuscaloosa of Alabama so that it is apparently a form with a wide stratigraphic range.

OCCURRENCE: EUTAW FORMATION, COFFEE SAND MEMBER. Coffee Bluff, Hardin County, Tennessee.

#### ANDROMEDA WARDIANA Lesquereux

*Andromeda Wardiana* Lesquereux, Mon. U. S. Geol. Surv. **17**: 119. *pl. 64, f. 17*. 1892; Berry, U. S. Dept. Int. Geol. Surv. Professional Paper 84: 120. *pl. 24, f. 3*. 1914.

Leaf elliptical in outline, entire. Apex and base equally narrowed but the apex bluntly rounded. Length 5.3 cm. Greatest width, which is halfway between the apex and the base, 2.3 cm. Midrib thin. Secondaries not made out. In the type they are thin, diverging at an angle of about forty degrees and camptodrome.

The type material came from the Dakota sandstone of Ellsworth County, Kansas. The Georgia material which came from the basal beds of the Eutaw formation shows a leaf which is a trifle larger but which in its general proportions and outline is identical with the western form, and there can be no doubt of their identity.

It is quite possible, in fact probable, that this species is not distinct from *Andromeda tenuinervis* Lesquereux, which, if the form referred to it by Hollick is correctly identified, approaches it closely in size. The two differ somewhat in texture and in the degree of acuteness of the apex, but whether these features are of specific value or not is an open question. The Tennessee material extends the range of this species to the upper part of the Eutaw formation.

OCCURRENCE: EUTAW FORMATION, COFFEE SAND MEMBER. Coffee Bluff, Hardin County, Tennessee.

EBENALES

EBENACEAE

DIOSPYROS Linné

DIOSPYROS PRIMAEVA Heer

*Diospyros primaeva* Heer, Phyll. Crét. d. Nebr. 19. *pl.* 1, *f.* 6, 7. 1866; Berry, U. S. Dept. Int. Geol. Surv. Professional Paper 84: 61. *pl.* 11, *f.* 3; *pl.* 14, *f.* 12, 13. 1914.

Leaves oblong-ovate in outline, variable according to age, ranging from 3–15 cm. in length, by 1.3–5 cm. in greatest width, which is in the middle part of the leaf. Apex acute or obtuse. Base cuneate. Margins entire. Petiole rather long and very stout. Midrib also stout. Secondaries branching from the midrib at usually acute angles, subopposite or alternate, parallel, camptodrome. Tertiaries forming polygonal areoles whose relative prominence is one of the features of this species.

This species, which is quite suggestive of the modern *Diospyros virginiana* Linné, was described by Heer from the Dakota group of Nebraska nearly half a century ago. It has proved to be a most wide-ranging form, having been identified at both the Atane and Patoot horizons in Greenland; in the Cenomanian of Saxony and the Turonian of Bohemia; from various localities within the Dakota group, including its southern extension, the Woodbine formation of Texas; and with the exception of the fragments from Marthas Vineyard and Long Island, which are of questionable identity, it is present in either the Raritan, or Magothy, or homotaxial formations from New Jersey to Alabama. Its most marked character is the prominence of its tertiary areolation.

OCCURRENCE: EUTAW FORMATION, COFFEE SAND MEMBER. Coffee Bluff, Hardin County, Tennessee.

INCERTAE SEDIS

HALYMENITES MAJOR Lesquereux

*Halymenites major* Lesquereux, Tertiary Flora 38. *pl.* 1, *f.* 7, 8. 1878.

These very common objects, frequently considered as fucoids, are abundant in the western United States in sandy beds ranging

in age from the Colorado group to the Eocene. They were long considered typical of the Fox Hills horizon but are now known from both older and younger beds and characterize sandy ferruginous sediments. Typical material is abundant in the Coffee sand member of the Eutaw formation at Coffee Bluff, Hardin County, Tennessee, and this is the first record of these objects in the coastal plain. It occurs also in sands of the Lower Ripley and in the McNairy sand of McNairy County, but in a very friable condition and these last horizons are not represented by collected material.

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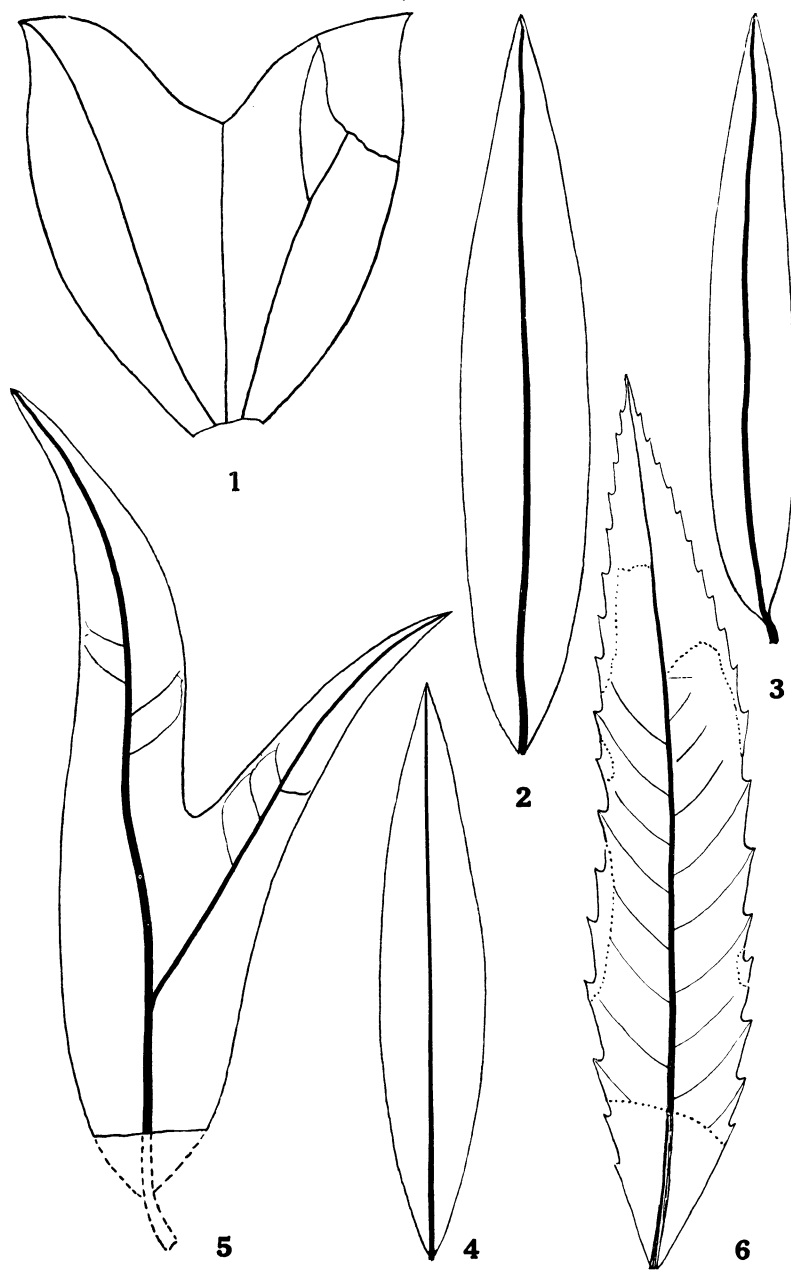
#### **Explanation of plate 15**

FIG. 1. *Bauhinia ripleyensis* Berry. More perfect specimen from Ripley, Barbour County, Alabama, to illustrate McNairy sand species.

FIGS. 2-4. *Eugenia* (?) *anceps* Berry. McNairy sand two and one half miles southwest of Selmer, Tennessee.

FIG. 5. *Sterculia Snowii tennesseensis* Berry. McNairy sand, two and one half miles southwest of Selmer, Tennessee.

FIG. 6. *Dryophyllum gracile* Debey. McNairy sand, near Cypress, Tennessee.



1. BAUHINIA RIPLEYENSIS BERRY  
2-4. EUGENIA (?) ANCEPS BERRY  
5. STERCULIA SNOWII TENNESSEENSIS BERRY  
6. DRYOPHYLLUM GRACILE DEBEY